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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Ski Training and Practising Apparatus

We, GERALD DOUGLAS [illegible] of 15 Elton Rise, London, N.W.3, MICHAEL JOHN PROSSER of 10 Sheering Road, Harlow, Essex, and HUGH SCUDAMORE of 3 Southwick Place, London, W.2, all British subjects, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to static outdoor or indoor training and practising apparatus for simulating water ski-ing. The objects of the present invention is to provide a relatively simple apparatus suitable for installation indoors or outdoors and intended to simulate conditions likely to be met with under real conditions to provide practice and training for such sports and to provide an enjoyable simulation of the conditions likely to be met with in practice.

In accordance with the present invention such apparatus includes an upwardly open water channel and pump means for maintaining a circulatory flow of water within said structure and in said channel to provide in said channel a water flow or such that a trainee or user is supported in a stationary position by the surface of the water and may perform movement simulating water ski-ing. Preferably a supply of water is introduced into the channel at one end and said channel slopes gently downwards towards the other end from which water is removed and is re-circulated to the other higher end of the channel.

The surface of the water in such channel serves to support the trainee or user who can then perform many of the movements which he would expect to have to perform under open water conditions when towed by a water craft.

Several embodiments of the present invention are illustrated in somewhat diagrammatic form on the accompanying drawings in which:

Fig. 1 is a plan view illustrating one simple form of the invention,

Fig. 2 is a side view of Fig. 1,

Fig. 3 is a view illustrating a water channel in transverse cross-section.

Fig. 4 is a side view illustrating the water circulation system in one embodiment of the invention,

Fig. 5 is a diagrammatic view illustrating a simple practical construction of the invention,

Fig. 6 is an intermediate level plan on the line VI—VI of Fig. 7 of the arrangement shown in Fig. 5 to show the water circulatory system,

Fig. 7 is a vertical sectional view on the line VII—VII of Fig. 5, and

Fig. 8 is a vertical sectional view on the line VIII—VIII of Fig. 5.

Referring first to Figs. 1 to 4 of the drawings which illustrate the primary features of the present invention, at least one water channel is provided but preferably and as shown in Fig. 1 two such channels 13 and 14 are provided each channel being arranged so that a continuous flow of water is maintained therein uniformly over the whole width of each channel, the water circulation being maintained by means of a pump and driving motor indicated at 15 and 16 respectively.

The water passes from the right-hand end of the channel 13 round a deflector guide casing 17 to the adjacent end of the channel 14 along, which the water then flows towards the intake of the pump 15. The delivery from the pump is effected at the left-hand side of the channel 13, that is to say, the water flows towards the right in the channel 13, then around the guide channel 17 and then to the left in the channel 14. The two channels 13 and 14 provide two water surfaces which can be used by two trainees or users with water skis and each with a cable and hand grip or suitable harness so as to ensure that they re-

[*Price 4s. 6d.*]

main in constant position relatively to the channels.

Preferably a sluice gate 18 (note also Fig. 7) is provided at the upstream end of each channel 13 and 14 to ensure that a proper depth of water is maintained in each channel and if desired each of the channels may be slightly inclined to the horizontal, as indicated in side elevation in Fig. 2.

Fig. 3 illustrates a preferred arrangement of each channel in greater detail, as applied to the channel 13 which supports a suitable depth of water, indicated at 19. This channel 13 is flanked by drainage channels 20 covered by metal grids or gratings 21 so that any water splashed from the trough is collected into the drainage channels and returns to the pump 15.

The invention is not limited to the provision of two parallel channels 13 and 14, as if desired in some cases a single channel would be sufficient, the water being returned from the lower end of that channel towards the pump 15 through a suitable duct or conduit. In another alternative the water could return from a single channel through a single deep passage not intended to provide a second training zone. In a still further arrangement a greater number of channels could be provided arranged in a polygonal system providing a number of separate training areas. Further a substantially circular channel could be used, various trainees or users being distributed around such channel.

If desired suitable means may be provided for producing waves on the water surface, which means could if desired be brought into action as and when required to simulate various water conditions. Such wave-forming devices may embody reciprocating members adapted to disturb the water surface so as to form travelling waves on the surface thereof, or the same effect could be obtained by cyclically varying the speed of the driving motor or by periodically changing the flow of water by means of a suitable flow regulating device. In a still further arrangement the sluices 18 (or equivalent weirs) could be cyclically raised and lowered thus giving a cyclic change in the depth of the water in the channels 13 and 14 giving a species of wave action on the surface of the channels.

The sluices or control gates 18 are provided at the upper ends of the channels 13, 14 and serve as a primary member for regulating the flow of water within the channels, and they have the effect of spreading out the water uniformly over the whole width of the channel and ensuring a smooth flow across the whole width thereof.

In some cases weirs 24 may be provided at the lower end of each channel which cooperate in maintaining a proper depth of water throughout the length of the channel, it being understood that maintenance of a proper depth of water throughout the length and width of the channel and of an adequate flow rate of the water is dependent on the placing of the sluices 18 above the base of the channel, on the overall slope of the channel from one end to the other and on the proper placing of the weir 24. All these elements are appropriately placed and positioned to ensure maintenance of the required water flow within the channels and of course both the sluices 18 and the weirs 24 may be adjustably mounted so that correct operating conditions can be set and maintained. If the production of wave-like effects is required the sluices 18 and/or the weirs 24 may be raised and lowered on a cyclic basis.

In practical arrangements according to the present invention the two channels 13, 14 preferably run side-by-side and slope in opposite directions, as also shown on Fig. 4, the arrangement in plan being as shown in Fig. 1. In the arrangement shown in Fig. 4 the pump 15 delivers water through a pipe feed 22 to a top box 23 which distributes the water into the upper end of the channel 13. The water leaving the channel 13 flows through a U-shaped water conduit 25 to the upper end of the channel 14 from which the water passes into a bottom box 26 and thence to the intake of the pump 15. In any case the pump assembly 15, 16 is conveniently arranged so that the water flow rate can be varied to give various flow speeds in the two channels, and the channels may be of different widths or depths at different points so that different surface flow conditions may be obtained at different points of each channel. To simulate water ski-ing conditions a cable connected to a fixed point and provided with a hand grip may be provided which is gripped by the trainee while resting on the moving water surface, and the channels may be provided with side rails which the user may hold, particularly at the start of training and to give confidence. Exposed parts of the apparatus may be suitably protected to prevent injury to a user and if desired suitable control means may be provided to drain water from the channel should this be necessary.

In practical constructions according to the invention features are included to maintain the smoothest possible water flow in the two channels and to eliminate any air which may be carried with the water as a result of any turbulence effects that appear. In general this requires the provision of guide vanes within the water passages for example within the supply tanks or boxes 26, 23 and in the U-shaped conduit 25 and additional baffles may be provided within the tanks that may form part of the equipment to prevent surging and assist elimination of any air which may be carried with the water.

Figs. 5 to 8 illustrate diagrammatically the main design features of practical forms of equipment in accordance with the present invention.

In Fig. 5 the two channels are again marked

13 and 14 and they form part of a fixed structure indicated generally at 31. The channels 13 and 14 are at different levels, as will be seen by comparison of Figs. 7 and 8, as already indicated also with reference to Fig. 2. The fixed structure includes end members 32, 33 covering parts of the structure used for feeding the water towards the different channels while the pumps, storage tanks and so on are arranged in a chamber in the lower part of the equipment, as indicated in Fig. 6, which is an intermediate section of Fig. 7. Figs. 6 and 7 show the pump 15 and the driving motor 16 which draw water from a storage tank 34 disposed beneath the channel 14 and feed the water through a pipe 35 to a delivery box 36 from which the water passes into the channel 13 beneath a sluice or gate 18. The water then passes along the channel 13 and a part of the water is drawn off through a drain pipe 37 into a tank 38 which drains into the tank 34 by means of a connecting pipe 41. The major proportion of the water however under normal operating conditions passes through a U-shaped channel 251 which performs the same function as the conduit 25 of Fig. 4, then into a deeper channel 252 and thence past the sluice gate 181 to the upper end of the lower channel 14. At the lower end of the latter channel the water passes directly into the tank 34 ready for withdrawing from the latter by the action of the pump 15.

The drain pipe 37 is provided to ensure that when the apparatus is shut down the water already present in the channel 13 can be drawn off into the tank 38 and so that the tanks 34 and 38 taken together can store the whole amount of water used in the circulatory system. In normal operation and with the channels 13 and 14 filled with water only a comparatively small amount of water is stored in the tank 38 while the tank 34 is only partially filled. Thus all the water may be stored within the equipment when the apparatus is out of use while in use there is a continuous circulation in the channels, the tanks 38 and 34 being only partially full. The upper orifice of the drain pipe 37 is so proportioned that only a relatively small quantity of water flows into the tank 38 in normal operation, the major part passing into the channel 251 and thence to the channel 14.

Guide vanes are indicated at 42 to maintain a smooth flow of water within the channel 251 and may also be provided elsewhere to maintain a smooth water flow, and additionally baffles 43 may be provided in the tank 34 and in some cases also in the tank 38 to prevent excessive turbulence in the tanks. These baffles may consist of perforated members extending downwardly from the upper wall of the tanks.

Certain refinements of the invention with a view to reducing the power requirements for circulating the water through the channels 13 and 14 are also illustrated in the drawings.

Referring to Figs. 5 and 8 it will be seen that the water leaving the channel 13 and passing into the U-shaped channel 251 enters the deeper channel 252, before it passes from the latter beneath the sluice gate 181 to enter the channel 14. Suitable provision may be made to ensure that the water flowing within the channel 251 changes its flow rate in the course of its movement within the channel, resulting in a change of level within the channel 251 with the consequent production of a "hydraulic jump" at the point where the velocity changes in a manner well understood in hydraulic engineering. This hydraulic jump may be formed within the bend shown on the drawings and on the two sides of the guide vanes 42 provided in this bend which has the effect of stabilising the position of the hydraulic jump although the same result may be obtained by other means such as providing a raised flared part of the conduit 251 over a short portion of its length.

Furthermore the drain pipe 37 ensures that this hydraulic jump phenomenon cannot move upstream into the channel 13 so that the phenomenon is stabilised within the initial curved part of the channel 251. The resulting increase in the water level represents a saving in energy and reduces the power needed to maintain the water in circulation.

If desired the tank 34 may be extended up to a point sufficiently beyond the lower end of the channel 14 to permit a similar hydraulic jump to be maintained in a stabilised position at the said lower end of the channel 14 giving a further reduction in the power required to maintain the water in circulation.

The invention is not limited however to the use of an open channel 251 as in Figs. 5 and 8, as closed ductways may be provided for this purpose as indicated at 25 in Fig. 4. When a closed duct is used in this way it is still preferable to provide a drain pipe such as shown at 37 in Fig. 5, that is to say, at the lower end of the channel in advance of the duct, this arrangement being desirable to prevent any possibility of a hydraulic jump being formed within the channel itself. If this arrangement is adopted the closed duct similar to 25 on Fig. 4 may incorporate guide vanes to regulate the water flow, and the cross-sectional area of the duct may be different at different points of its length. By appropriate design in this way it is possible to secure economy in energy consumption comparable to or even greater than that obtained when the open conduit system 251 is used.

As indicated on Fig. 5, the channels 13 and 14 may be flanked by the drainage channels 10, as shown on Fig. 3 of the drawings, and the space between the two channels may include a horizontal surface 44 at approximately mid level of the channel 13 to give access to the channel, and said horizontal surface could

if desired be used as a restaurant or cafe. This horizontal surface 44 may communicate via a staircase 45 with a lower level walkway 46 disposed at approximately mid level of the channel 14 and the space beneath the floor area 44 could be used to accommodate changing rooms.

If desired, one or both of the channels may be provided with a deeper area 47 to provide the possibility of training in a deep water area and particularly for instructing trainees to raise themselves from a crouching position in a moving water current. This deeper water area is indicated on Figs. 5 and 7 as being comparatively short in relation to the double length of the equipment, but of course the deeper area can be extended along one or both channels if desired.

The ski-ing apparatus of this invention may be associated with means for increasing realism, for example moving or static scenery, or optical projectors producing fixed or moving pictures on suitable screens and audible effects and/or sunlight conditions may be simulated.

A beginner may use a harness similar to a parachute harness with a cable or pole leading from the harness, for example from between the shoulder blades, to a suitable mounting or support above the ski apparatus.

WHAT WE CLAIM IS:—

1. Apparatus for simulating water skiing comprising a structure including an upwardly open water channel and pump means for maintaining a circulatory flow of water within said structure and in said channel, to provide in said channel a water flow such that a trainee or user is supported in a stationary position by the surface of the water and may perform movements simulating water ski-ing.

2. Water ski-ing apparatus according to claim 1, wherein a supply of water is introduced into the channel at one end and said channel slopes gently downwards towards the other end from which water is removed and is re-circulated to the other higher end of the channel.

3. Water ski-ing apparatus according to claim 2, wherein the channel is relatively wide and shallow and water is introduced into said channel beneath a guide plate or sluice which induces a flow of water in said channel uniformly over the width of the channel and to a predetermined depth to provide a continuous flow of water appropriate for water ski-ing practice or training.

4. Water ski-ing apparatus according to claim 2, wherein the terminal lower end of the channel includes a weir to assist in maintraining an adequate depth of water throughout the length of the channel.

5. Water ski-ing apparatus according to claim 1, wherein two channels are arranged side-by-side and sloping in opposite directions, water passing from the terminal end of the first channel through a passageway to the upper end of the second channel which lies at a lower level than the lower end of the first channel.

6. Water ski-ing apparatus according to any of claims 1 to 5, wherein the water leaving a channel is conveyed through a further open channel and a hydraulic jump is formed at a predetermined point of said further channel where the depth of water changes from a first value to a greater value and in which the position of the hydraulic jump is stabilised by means of a lengthwise directed baffle or guide plate within the channel or by providing for abstracting a fraction of the water from the base of the further channel.

7. Water ski-ing apparatus according to any of claims 1 to 6, wherein water circulating means are provided adapted to supply water to the upper end of the second channel or to the upper end of the first channel and to abstract the water from the lower end of the first channel or from the lower end of the second channel and to convey it towards the intake to the circulating means.

8. Water ski-ing apparatus according to claims 4 to 7, wherein a storage tank 34 is provided lengthwise beneath the second channel and a further storage tank 38 is provided transversely between the lower and of the first channel and the upper end of the second channel, the two tanks communicating one with the other and being proportioned to accept the whole of the water in circulation in the system so that the channels may be emptied of water while out of use.

9. Water ski-ing apparatus according to the last preceding claim, wherein a drain pipe is provided extending directly between the lower end of the first channel and the second tank to provide a flow path additional to that provided by a guide passage between the first channel and the second channel and adapted to assist in draining the channels when required.

10. Water ski-ing apparatus according to any of claims 1 to 9, wherein guide vanes are provided within water flow spaces leading into or away from the channel or channels to assist in maintaining a smooth water flow and in removing air carried with the water, and wherein in addition storage tanks for the water are provided with baffles to minimise surge of water in said tanks.

11. Water ski-ing apparatus according to any of claims 1 to 10, wherein said channel or one of said channels is provided with a depression to provide a deep water area.

12. Water ski-ing apparatus according to any of claims 1 to 3, wherein a plurality of said channels are arranged in a polygonal pattern, as seen in plan, or said channels are arranged in a circular path.

13. Water ski-ing apparatus according to any of claims 1 to 12, wherein each channel is flanked by a drain channel provided with

perforated cover to receive water spilled from the said channel.

14. Water ski-ing apparatus according to claims 1 and 2, wherein means are provided to produce cyclic changes in the water flow or level to obtain wave effects on the water.

15. Water ski-ing apparatus according to claim 3 or 4, wherein the guide plate or sluice and/or the weir are cyclically raised and lowered or the operating speed of a pump producing the flow of water in the channels is cyclically varied.

16. Water ski-ing apparatus according to any of the foregoing claims, including a supporting harness suitable for fitting to the shoulders of a trainee and linked to a fixed support such as a cable running from a pole or other fixed part of the stationary structure.

17. Water ski-ing apparatus, substantially as herein described and illustrated.

WHEATLEY & MACKENZIE,
17 Wilson Street,
London, E.C.2.
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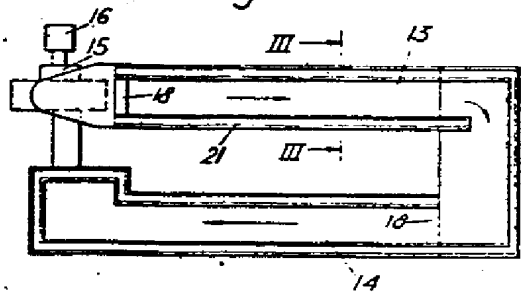
Fig. 1.



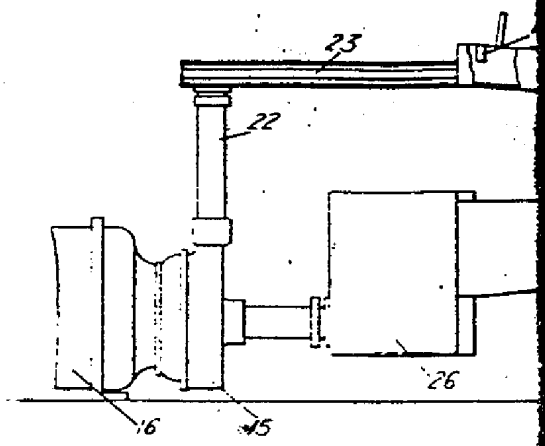


Fig. 2.

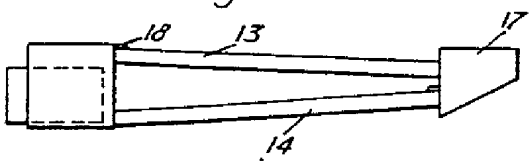


Fig. 7.

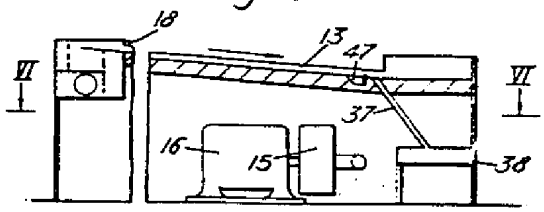


Fig. 3.

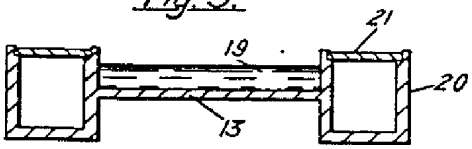


Fig. 8.

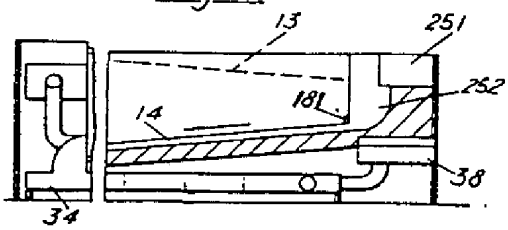


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Fig. 4.

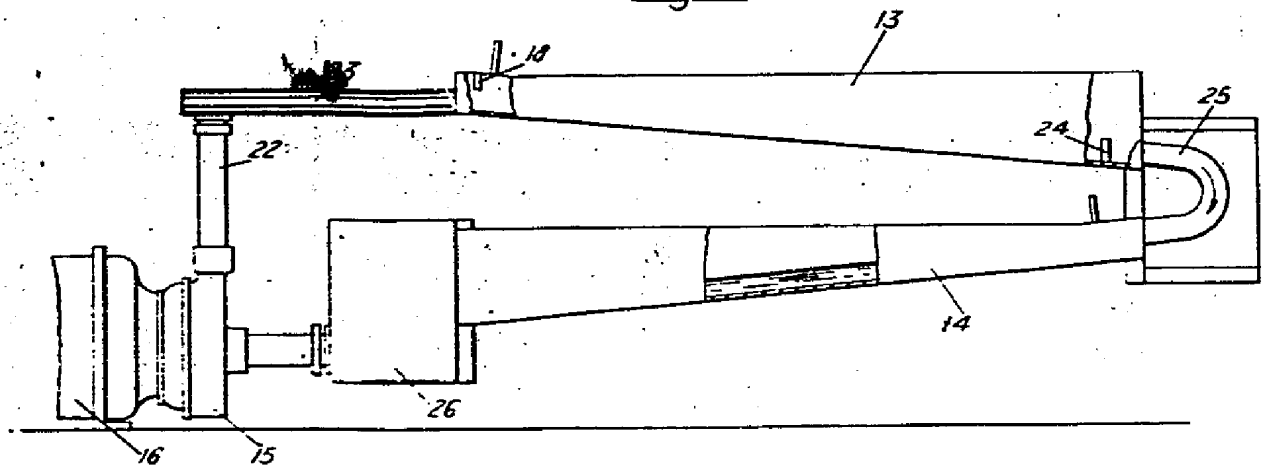

Fig. 7.

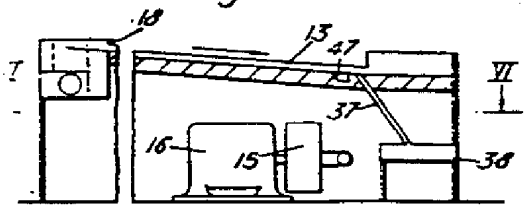

Fig. 5.

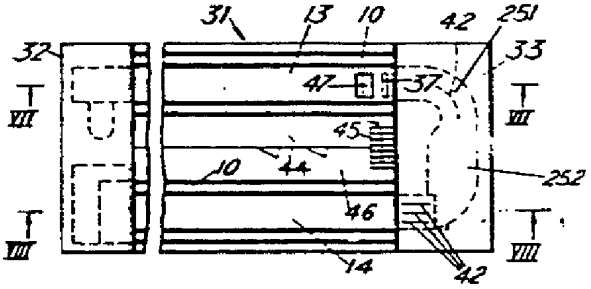

Fig. 8.

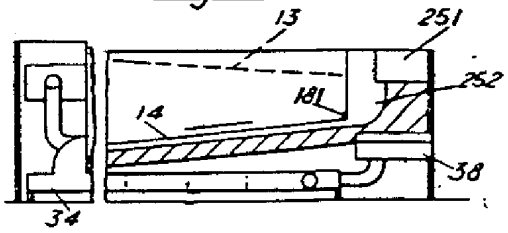

Fig. 6.